

What is claimed is:

1. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a tryptophan residue in a first position corresponding to position 477 of SEQ ID NO: 2 and a tryptophan residue in a second position corresponding to position 479 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.
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- 10 2. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a tryptophan residue in a first position corresponding to position 477 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.
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- 20 3. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a tryptophan residue in a first position corresponding to position 479 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.
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4. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a tryptophan residue in a first position corresponding to position 302 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.
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5. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a tryptophan residue in a first position corresponding to position 315 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-

like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.

6. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent
5 conditions and encoding a protein having a phenylalanine residue in a first position corresponding to position 318 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.

10 7. Another embodiment of this aspect of the invention relates to an isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a phenylalanine residue in a first position corresponding to position 328 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.

15 8. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a phenylalanine residue in a first position corresponding to position 318 of SEQ ID NO: 2, and a phenylalanine residue in a second position corresponding to position 328 of SEQ ID NO: 2, which upon binding an epoxy
20 farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.

25 9. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a tryptophan residue in a first position corresponding to position 498 of SEQ ID NO: 2, a tryptophan residue in a second position corresponding to position 499 of SEQ ID NO: 2, and phenylalanine residue in a third position corresponding to position 318 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.

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10. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having an tryptophan residue in a first position corresponding to position 498 of SEQ ID NO: 2, a tryptophan residue in a second position corresponding to position 499 of SEQ ID NO: 2, and phenylalanine residue in a
5 third position corresponding to position 328 of SEQ ID NO: 2, which upon binding an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.
11. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent
10 conditions and encoding a protein having an tryptophan residue in a first position corresponding to position 498 of SEQ ID NO: 2, a tryptophan residue in a second position corresponding to position 499 of SEQ ID NO: 2, and phenylalanine residue in a third position corresponding to position 318 of SEQ ID NO: 2, and phenylalanine residue in a fourth position corresponding to position 328 of SEQ ID NO: 2, which upon binding
15 an epoxy farnesoid-like ligand results in transcriptional activation of a nuclear hormone receptor reporter construct.
12. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having an phenylalanine residue in a first position
20 corresponding to position 318 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.
13. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having a phenylalanine residue in a first position
25 corresponding to position 318 of SEQ ID NO: 2, and a phenylalanine residue in a second position corresponding to position 328 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.
14. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent
30 conditions and encoding a protein having an tryptophan residue in a first position corresponding to position 498 of SEQ ID NO: 2, a tryptophan residue in a second

position corresponding to position 499 of SEQ ID NO: 2, and phenylalanine residue in a third position corresponding to position 318 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.

5 15. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having an tryptophan residue in a first position corresponding to position 498 of SEQ ID NO: 2, a tryptophan residue in a second position corresponding to position 499 of SEQ ID NO: 2, and phenylalanine residue in a third position corresponding to position 318 of SEQ ID NO: 2, and phenylalanine residue 10 in a fourth position corresponding to position 328 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.

15 16. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having an alanine residue in a first position corresponding to position 472 of SEQ ID NO: 2 and leucine residue in a second position corresponding to position 475 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.

20 17. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having an arginine residue in a first position corresponding to position 302 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.

25 18. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having an arginine residue in a first position corresponding to position 293 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.

30 19. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent conditions and encoding a protein having an alanine residue in a first position

corresponding to position 288 of SEQ ID NO: 2, which has dominant negative nuclear hormone receptor activity.

20. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent
5 conditions and encoding a protein having an alanine residue in a first position
corresponding to position 366 of SEQ ID NO: 2, which has dominant negative nuclear
hormone receptor activity.

21. An isolated nucleic acid capable of hybridizing to SEQ ID NO: 1 under stringent
10 conditions and encoding a protein having an alanine residue in a first position
corresponding to position 366 of SEQ ID NO: 2 and an alanine residue in a second
position corresponding to position 288 of SEQ ID NO: 2 which has dominant negative
nuclear hormone receptor activity.

15 22. The protein of any of claims 1 to 11.

23. The protein of any of claim 12 to 21.

24. A method of identifying ligands of nuclear hormone receptors comprising:
20 contacting any of the mutant nuclear hormone receptor proteins of any of claims 1 to 22
with at least one candidate ligand; and determining whether there is a change in a
physical property of the protein or a change in the transcriptional activity of the protein as
a result of the contact between the protein and each candidate ligand.

25 25. A method of identifying a pest control agent comprising:

- (a) contacting any of the mutant nuclear hormone receptor proteins of any of
claims 1 to 22 with at least one candidate ligand;
- (b) selecting the candidate ligand such that upon binding to the protein results
in a change in a physical property of the protein or a change in the
transcriptional activity of the protein;
- (c) determining whether the selected ligand binds the wild type RXR.

26. A nuclear hormone receptor response element denoted by the formula YDRXZ comprising a direct repeat (DR) comprising two half sites separated by X nucleic acid bases; wherein Z indicates the presence of a forward DR sequence of 5'-
5 AGGTCA(N)_xAGGTCA-3' (SEQ ID NO: 8) and/or a reverse DR sequence of 5'-TGACCT(N)_xTGACCT-3' (SEQ ID NO: 9); wherein the element comprises at least one DR oriented in either a forward or reverse orientation; wherein Y equals 1 to 8 forward and/or reverse direct repeats; and X equals 1 to about 12; with the proviso that the element is not 4DR12ffffr.

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27. A nuclear hormone receptor reporter construct comprising a nuclear hormone receptor response element, a promoter and a reporter nucleic acid sequence operably linked to one another; wherein the hormone receptor response element denoted by the formula YDRXZ comprising a direct repeat (DR) comprising two half sites separated by X nucleic acid bases; wherein Z indicates the presence of a forward DR sequence of 5'-AGGTCA(N)_xAGGTCA-3' (SEQ ID NO: 8) and/or a reverse DR sequence of 5'-TGACCT(N)_xTGACCT-3' (SEQ ID NO: 9); wherein the element comprises at least one DR oriented in either a forward or reverse orientation; wherein Y equals 1 to 8 forward and/or reverse direct repeats; and X equals 1 to about 12; and wherein the promoter is
15 selected from the group consisting of SEQ NOs: 3, 4, 5, 6 and 22; with the proviso that
20 the element is not 4DR12ffffr.

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28. The nuclear hormone receptor reporter construct of claim 27, wherein the reporter nucleic acid sequence encodes luciferase.

29. A nuclear hormone receptor response reporter construct comprising an Aryl core (SEQ ID NO: 6) operably linked to two copies of an EcRERF (SEQ ID NO: 7) nuclear hormone receptor response element and a reporter nucleic acid.

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